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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/675,044	09/30/2003	Nelson Bolton	626-119	5420

7590 09/13/2006  
John Lezdey and Associates  
2875 MCI Drive  
Pinellas Park, FL 33782

EXAMINER

SPAHN, GAY

ART UNIT PAPER NUMBER

3635

DATE MAILED: 09/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Interview Summary</b>	Application No.	Applicant(s)	
	10/675,044	BOLTON ET AL.	
	Examiner	Art Unit	
	Gay Ann Spahn	3635	

All participants (applicant, applicant's representative, PTO personnel):

- (1) Gay Ann Spahn. (3) \_\_\_\_.
- (2) John Lezdey. (4) \_\_\_\_.

Date of Interview: 07 September 2006.

Type: a) ☒ Telephonic b) ☐ Video Conference  
c) ☐ Personal [copy given to: 1) ☐ applicant 2) ☐ applicant's representative]

Exhibit shown or demonstration conducted: d) ☐ Yes e) ☒ No.  
If Yes, brief description: \_\_\_\_.

Claim(s) discussed: None.

Identification of prior art discussed: None.

Agreement with respect to the claims f) ☐ was reached. g) ☐ was not reached. h) ☒ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: See Continuation Sheet.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.

Gay Ann Spahn  
Examiner's signature, if required

## Summary of Record of Interview Requirements

### Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

### Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews

#### Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

#### 37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,  
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

### Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: My Lezdey called to say that he had received a copy of the Notice of Non-Responsive Amendment mailed on 11 August 2006 in which the examiner had noted that Applicants' copy of the originally filed specification appeared to have different pagination than the copy of the originally filed specification on file in the examiner's image file wrapper (IFW). The examiner suggested that Applicants should refer to Public PAIR to get a copy of the specification as originally filed. However, Mr. Lezdey noted that this application was not published and therefore, he could not get a copy of the specification from Public PAIR. The examiner stated that she would fax a copy of the originally filed specification (pages 1-15 and Abstract on page 18) to Mr. Lezdey.

## **Laminate Suspension System**

### **Field of the Invention**

The present invention relates to a glazing unit and particularly a novel glazing unit having unique means for mechanically fastening such glazing units to be fixed to a supporting structural glazing assembly for forming a continuous façade having an extensively smooth outer surface from such glazing units.

### **Description of the Prior Art**

Various technological arrangements are known for mounting glazing units to provide the aesthetical and architectural benefits of continuous glazed façades which are typically fixed on high rise buildings. Generally the glazed façade assembly in the form of glass panels or units is mechanically secured to a substructure of the façade. The substructure is mounted on the outside of a load bearing building skeleton of metal or reinforced concrete. However, the means for mechanical fastening for this purpose involves some projecting parts and/or providing fastening holes through the layers of glass which distort the outer surface of the panels.

In an attempt to obtain the desired smooth outer surface of the façade form which no parts are projecting and the individual glass units remain integral, the glass panes were mounted exclusively by means of adhesive bonding. For safety reasons, building authorities have not generally permitted such glass facades without positive locking. Moreover, the prior art methods are limited to certain thickness of glass.

The current practice in façade construction is described in U.S. Patent No. 4,481,868 to McCann, which is incorporated herein by reference, discloses mechanically fastening sections of glass panels to the supports of a building. That patented glass

assembly comprises a planar array of sealed multiple glazing units each comprising two opposed spaced sheets with a seal between the sheets defining a sealed gas space, which units are secured to supporting members with the outer surface of the units sealed edge-to-edge, at least some of the units being secured to the supporting members by a mechanical fixing passing through the outer sheets of the units outside the seals of the units. In a preferred embodiment each unit is a multiple glazing unit which is secured to the supporting member by bolts whose heads are countersunk into holes countersunk in the outer face of the unit outside of the seal of the unit. The outer surface of the outside sheet of the glazing unit is protected against destructive stress cracks by cushioning with bushings and washers placed between the bolt and the glazing surfaces. The bushings and washers prevent glass-to-metal contact and prevent damage to the glazing sheets.

There are several disadvantages in the patented glass assembly directed to aesthetics and the manner of assembly. The holes required to accommodate the attaching bolts weaken the entire unit, destroy the integrity and smooth surface of the outer panel. The flat headed bolts even if countersunk into the glass detract from the uninterrupted planar appearance of the outside of the assembly. The necessity to carefully drill through multiple layers of glass and align these pieces constitutes a difficult and costly manufacturing problem. The drilling of glass to produce a countersunk hole usually requires two steps and may entail considerable glass breakage. Likewise, if the holes are not properly aligned, during assembly of the façade the tightening procedure will result in breakage resulting in down time and material loss.

The McCann patent does not disclose any laminated structure. The critical feature of the present invention is a glazing unit having embedded in an ionomer polymer layer a mechanical securing element.

It is known in U.S. Patent No. 2,310,402 to Dennison, which is incorporated herein by reference, to provide a glass insulation unit of a glass laminate wherein a metal border is embedded in plastic interlayers.

U.S. Patent No. 4,029,942 to Levin, which is incorporated herein by reference, discloses bus bars embedded in transparent laminates to provide electrical contacts to heat windows for defrosting and defogging.

U.S. Patent No. 4,799,346 to Bolton and Smith, which is incorporated herein by reference, discloses an attachment member mounting embedded in a transparent resinous layer of a laminate glazing unit. The attachment member mounting is fastened to a frame or support structure by bolting or clamping. In a preferred embodiment a resistance means for preventing removal of the mounting is in form of protrusions which extend from the plane of the member on that portion which is embedded within the interlayer. Among the resins suitable for use as interlayers for the laminate are mentioned ionomer resins.

The present case distinguishes from the Bolton and Smith patent in that the present invention is a glazing unit integrated with a mechanical securing element which eliminates the need for the attachment mounting element of the patent.

#### **Summary of the Invention**

According to the present invention a novel glazing unit is disclosed having at least one mechanical securing element embedded within a polymer layer, preferably an

ionomer, bonded to at least one monolithic glazing element to provide an integrated mounting system enabling such units to be fixed to a support without disruption or distortion of the monolithic structure of the glazing element. A plurality of glazing units are capable of being mounted in a planar array on the outer surface of a building having a concealed framework to produce a continuous glazed façade.

In its broadest aspect the present invention relates to a novel glazing unit comprising: at least one monolithic glazing element bonded to at least one polymeric layer having embedded therein a mechanical securing element selected from male or female interactive fastening means. Either the male or the female securing element can be embedded in the polymer. The invention is applicable to any glazing construction ranging from single laminates and/or multiple panes.

When a laminated multiple glazing unit such as a double glazing unit is involved, a hole or slot is formed in the internal glazing element to accommodate the stem of a male securing element. In a glazing façade assembly procedure the male stem is aligned with and passes through a hole or slot in a support structure regardless which securing element is embedded.

The external and/or internal glazing sheets may be any well known commercial plate, float or sheet glass composition. Also plastics which are well known in the plastics art such as polycarbonate polymers may be used either alone or in combination with glass glazing or with other plastics. An ionomer copolymer forms excellent strong bonds with glass, metals and plastic materials.

The polymers useful in this invention for forming a bonding layer (single glazing) or laminate interlayer and embedding a mechanical securing element are those capable of



providing the high tensile strength necessary to support multiple glazing units. Furthermore, the ionomer copolymer layer maintains the integrity of the glazing units when they are subjected to physical impact or thermal stress.

It has been found that ionically crosslinked copolymers of ethylene-methacrylic or acrylic acid or ethylene-methacrylic or acrylic-acid-polyamine provides the toughness, high clarity, and superior tensile strength, are most useful. The ionomers are at least partially neutralized with an alkali metal cation.

The mechanical securing element which is embedded within the ionomer layer may be any male-female coacting mechanical fastening means. As mentioned above, either the male or the female securing elements can be embedded. The mechanical securing elements in combination are a means for securing the glazing unit to a supporting frame or other load bearing structure. Preferably, a bolt and nut provides a mechanical connection by simply screw-tightening the glazing unit against the supporting structure. Other mechanical securing combinations include snap together couplings, clamps, and the like.

A compressable and/or flexible material may be interposed at metal to glass or metal to plastic interfaces in the form of bushings, gaskets, sleeves, seals, or washers.

It is the primary object of the present invention to provide a glazing unit having means for securing the glazing unit to a frame or other structural support.

Another object of this invention is to improve the integrity of the glazing unit in the frame or structural support when subjected to high physical impact or thermal stress.

A further object of this invention is to ensure a safe retention of the glazing unit in position even in case of the breakage or cracking of the glazing element.

A still further object of this invention is that the glazing unit secured in the manner disclosed appears devoid of any projection or visible fixing element.

Yet another object of this invention is to provide a plurality of an improved glazing unit for producing a planar array on a building exterior having an uninterrupted surface, uniformity and continuity in reflection and color.

Still yet another object of the invention is to provide a laminate for the fixed windows of automobiles and aircraft such as windshields and canopies:

Other objects and a fuller understanding of the invention will be had by referring to the following description and claims of a preferred embodiment, taken in conjunction with the accompanying drawings, wherein like reference characters refer to similar parts throughout the several views.

#### **Brief Description of the Drawings**

**Fig. 1** is a cross-sectional view of a single glazing unit having a male mechanical securing element, a bolt head, embedded in a bonded ionomer copolymer layer.

**Fig. 2** is a cross-sectional view of a double glazing unit having a female mechanical securing element, a capped nut, embedded in the bonded ionomer copolymer layer.

**Fig. 3** shows a sectional view of a plurality of the laminated glass glazing units 20 as illustrated in **Fig. 2** forming a glazing assembly of planar rectangular panels.

**Fig. 4** is a cross-sectional view of a double glazing unit having a female securing element in the form of a flange and stud.

**Fig. 4A** is a cross-sectional view along line y-y of **Fig. 4**.

#### **Detailed Description of the Preferred Embodiments**

Referring to drawings Figs. 1 to 4, there are illustrated a novel single glazing unit, a laminated glazing unit and a glazing assembly according to this invention. A plurality of these glazing units when arranged in a planar array and mechanically secured to a concealed structural support member of a building form a glazing assembly having a monolithic façade with aesthetical and practical architectural benefits.

The simplest application of this invention as shown in Fig. 1 involves a single monolithic glazing unit 10 which comprises a monolithic external glazing element 11 such as a glass glazing having a smooth outer surface 11a and an inner surface 11b bonded to an internal polymer layer 12 which is preferably an ionomer having surfaces 12a and 12b and embedded therein at least one male mechanical securing element 7 such as bolt 17. The bolt 17 comprises a flat head 18 and a threaded stem 16. As shown in the figure, the flat head 18 is totally embedded within the polymer layer 12 in a fixed position with the threaded stem 16 projecting from the glazing unit 10. A female mechanical fixing element nut 19 is connected to the threaded stem 16 to form a mechanical securing assembly and enables the monolithic glazing unit to be secured to a structural support 14 (partially shown) by tightening the nut 19. The inherent properties of adhesive strength and high tensile strength of the polymer locks the flat head 18, increases the load bearing capacity of the mechanical securing assembly and accepts increased load bearing pressure.

In practice the installation of the monolithic glazing unit 10 to a support structure 14 involves passing the threaded end 16 of the bolt 17 through a bushing 13 and circular hole 15 of support structure 14. The hole 15 has a diameter slightly larger than the threaded stem 16 to provide adequate clearance to compensate for the monolithic glazing

unit 10 which is secured to the support structure 14 by tightening nut 19 on the threaded stem 16 at face 12b of the ionomer layer 12. The tightening action causes pressure to be distributed through the bushing 13. The bushing 13 is of sufficient size and elasticity to accommodate relative movements between the ionomer layer 12 and the structural support 14.

A plurality of the monolithic glazing units 10 may be employed in a planar array as a building façade or an interior ceiling and wall assembly in which each of the laminated glazing units are secured to a support structure by mechanical securing assembly wherein at least one element of the assembly is embedded in the polymer layer of the laminate.

The term "monolithic" as used herein relates to a glazing element to be integral, i.e., without holes or fragmentations.

In Fig. 2 there is shown a laminated multiple glazing unit, specifically a glass double glazing unit 20 comprising an external glass element 21 having an outer surface 21a and an inner surface 21b and an internal glass element 23 also having outer and inner surfaces 23a and 23b which are bonded together with polymer interlayer 22. The interlayer 22 has embedded therein a female securing element such as a capped nut 27. A circular fixing hole 24 is formed through the internal glass element 23 and has a diameter slightly larger than that of the mechanical fixing element 26. In this case the male fixing element is a bolt 26 comprising a head 25 and a threaded end which is sized to engage the embedded capped nut 27. As seen in Fig. 3, the laminated glazing assembly 30 (Fig. 2) is constructed from a plurality of laminate multiple glazing units. Each glazing unit has an uninterrupted outer surface which can be secured to a concealed supporting framework

to provide an uninterrupted planar appearance of the outside of the assembly. Preferably, the multiple glazing unit is a laminated glass double glazing unit 20 as described in Fig. 2. This glazing unit 20 is integrated with the mechanical connection with bolt 26. The façade assembly procedure for attachment of each glazing unit 20 typically involves units having rectangular or square shapes with the mechanical securing element embedded in each corner. In this case the threaded end of bolt 26 is passed through hole 15 in support structure 14 through bushing 28 and through fixing hole 24 to connect with embedded capped nut 27.

After engaging the capped nut 27 the bolt head 25 is torqued to exert force on bushing 28 which distributes the pressure to the inner surface 28 which distributes the pressure to the inner surface 23b thus securing the glazing unit 20 to the support structure 14. Various arrangements of compressible elastomeric gaskets, washers and seals in addition or in place of the bushing shown may be used to avoid glass-to-metal contact and prevent damage to the glazing sheets. Such arrangement and choice of compressible and/or flexible material is clearly known in the glazing art.

The critical feature of the invention resides in that at least one of the mechanical securing elements is embedded in an ionomer or polymer layer or interlayer. The mechanical securing assembly useful in this invention results from the interaction of male-female components either of which may be embedded in the ionomer layer without any consequence.

The terms "external" and "internal" as used herein refer to the position of these elements relative to the façade.

**Fig. 3** illustrates a laminated glass double glazing assembly **30** comprising a planar array of laminated glass double glazing units **20** as shown in **Fig. 2** each of which are mechanically secured at their respective corners to conceal support members **14** behind the array which are part of a structural framework to which the glazing assembly **30** is secured. The outer glass glazing surface **21a** of the double glazing units **20** are positioned edge-to-edge so as to appear to be continuous. However, a small gap between adjacent edgers can remain and this can be sealed with a silicone sealant as indicated at **31** if required.

**Fig. 4** shows another embodiment of this invention in which a female mechanical securing element **50** as shown in **Fig. 4A** is embedded in the polymer layer **42**. The construction of the securing element **50** involves a metal flange **49** attached to an internally threaded stud **48**. Additionally the flange has a plurality of spaced apart circular holes **51**. These holes provide additional surface areas for adhesion to the ionomer polymer layer **42**. The laminated double glazing unit **40** comprises external glass glazing element **41** and internal glass glazing element **43** bonded together with the polymer interlayer **42** having embedded therein the female securing element **50**. A bolt **45** having a threaded end provides the necessary male securing element. The bolt head **44** is torqued to tighten the glazing unit for attachment to a support structure **14**. In this construction the weight of the glazing unit is borne by the polymer layer **42**. Preferably, the flange and stud are welded together and employ stainless steel as the material of construction.

The glazing material preferred for either external or internal elements may be any with known commercial plate float or sheet glass compositions. The glass may be

tempered or non-tempered or chemically strengthened. Synthetic polymers to which the ionomer polymer resin provides good adhesion which includes polycarbonate resins, fused acrylic/polycarbonate resins, polyurethane, etc. The invention contemplates the use of one or more inner or outer layer of various polymer combinations preferably the inner layer is an ionomer layer and has embedded therein the mechanical securing element. The glazing material may range from transparent to opaque, may be tinted or deeply colored. The glazing material may include coatings which provide specific properties or special effects such as reflecting and non-reflecting properties, ultraviolet radiation absorbing, etc.

The thickness of the glazing may vary from about 8 mm to 19 mm for the external unit and between about 5 to 15 mm for the internal unit. The thickness of the ionomer polymer layer or interlayer will range from 3 to 60 mm. The good adhesion and the high tensile strength of the ionomer polymer allows for multiple glazing units in excess of three or more glazing elements. Further the thickness of each element may vary which allows for a wide latitude in glazing design.

Thermoplastic interlayer usable in the invention must be capable of strongly bonding to a rigid panel such as glass to form an impact-dissipating layer in a laminated safety glass assembly. Exemplary thermoplastics include poly(ethyl-vinyl acetate), poly(ethylene-vinyl acetate-vinyl alcohol), poly(ethylene-methyl methacrylate-acrylic acid), polyurethane, plasticized polyvinyl chloride, polycarbonate, etc. Polyvinyl butyral (PVB) and more particularly partial PVB containing about 10 to 30 weight % hydroxyl groups expressed as polyvinyl alcohol is preferred. Such partial PVB further comprises about 0 to 2.5 weight % acetate expressed as polyvinyl acetate with the balance being

butyral, expressed as polyvinyl butyral. The non-critical thickness of the thermoplastic sheet can vary and is typically about 0.25 to 1.5, preferably about 0.35 to 0.75 mm. PVB sheet is commercially available from Monsanto Company as Saflex ® sheet and E.I. Dupont de Nemours and Co. as Butacite ® polyvinyl butyral resin sheeting.

Preferred interlayers are ionomers such as disclosed in U.S. Patent No. 5,763,062 and 4,663,228 which are herein incorporated by reference. Most preferable are the ionomers which have been at least partially neutralized with an alkali metal cation and a polyamine.

The mechanical securing assembly can be of a typical mechanical fastening means, besides the nut and bolt assembly mentioned above, various retention clamps, clips and means for snap together engagement are usable for this purpose. The glazing assembly is not only easy to install by virtue of the simple construction of the fixing means but the integrity of the external units is maintained so that continuous uninterrupted planar appearance of the outside assembly is provided. Suitable metals useful as materials for the mechanical securing assembly include aluminum and steel but preferably corrosion resistant materials such as stainless steel and high impact plastics including fiberglass and thermoset phenolic-aldehyde polymers.

Fixing inserts of compressable and/or flexible materials are used at metal-glazing material contact areas to prevent stress cracking as well as to improve impact resistance, compensation for thermal expansion and to secure watertightness. Fixing inserts of elastomeric material in form of bushings, gaskets, sleeves, spacers and washers are used in bolt-fixing insert, nut-fixing assembly systems. The specific securing assembly of the



mechanical connection will vary depending on the size and design of the individual glazing units and the final façade design.

#### **Example 1**

A windshield is prepared by inserting a 3-4 mm interlayer of an ionomer (NOVIFLEX ® sold by AGP Plastics, Inc. of Trumbauersville, PA.) between two sheets of glass of 10 mm thickness in which aligned holes are prebored partially in the ionomer and completely through the inside layer of the glass. A stainless steel stud having a tapered head with a standard 82 degree taper was inserted into the ionomer. The barrel of the stud is 20-25 mm in diameter and the head is tapped with a 9 mm coarse thread. A metal or plastic bushing is used to hold the inner glass layer in place. The assembly is placed in a so called "polymer" bag of the type disclosed in U.S. Patent No. 3,311,517 to Keslar et al. The bag comprises an outer ply of polyethylene terephthalate and an inner ply of polyethylene bonded thereto. The bag is inserted into a second bag evacuated and sealed. The unit is placed in an autoclave at 225°F for three minutes under 150-200 psi pressure in a vacuum. The vacuum causes the ionomer to flow and seal the opening and set the bolt.

If required, a large washer or metal strip with plastic cushioning may be used to tighten the assembly and to provide further security in the event that the outer glass is broken. Depending upon the size and weight of the laminate several fastening means can be used.

The form of the invention shown and described herein represents illustrative preferred embodiments and variations thereof. It is understood that various changes may be made without departing from the gist of the invention as defined in the claims.

### **Example 2**

The preparation of a sample glass unit similar to that described in Fig. 2 was conducted as follows:

A cross-linked partially neutralized ethylene-acrylic acid ionomer resin was added to the resin port of a small extruder having an extruding barrel temperature which was maintained at 165-205°C. A film (50-60 mils) was extruded and cut into 12 squares of about 25.4 mm, stacked to about 13 mm thickness between two sheets of tempered glass one of which had a hole of 12 mm drilled in the center of the sheet. A 9 mm stainless steel capped nut was placed in the hole. The glazing unit was placed in a vacuum bag comprising an outer ply of polyethylene terephthalate and an inner ply of polyethylene bonded thereto. The bag was inserted into a second bag of the same material, evacuated and sealed. The sealed bag assembly was placed in an autoclave at 125°C for three minutes under 150-200 psi in a vacuum. The autoclave was reduced in pressure and cooled to room temperature. The bag assembly was removed from the autoclave and plastic wrappings were removed from the glass unit. This procedure embedded and fixed bonded the capped nut. A 9 mm stainless steel bolt was connected to and screwed into the fixed capped nut.

The glazing unit was then tested with tension applied at the head of the bolt. The indicated a strong adhesive bond of the ionomer polymer with the capped nut and a high tensile strength of the inherent in the ionomer layer.

It is intended that the primary use of the units constructed in accordance with the invention will be in the commercial glazing industry, particularly when flash glazing is required. In addition to this architectural glazing which can provide a desirable external

appearance due to the uninterrupted planar array of an outside assembly, the glazing units can provide the same effect for a decorative interior wall or ceiling. The glazing units of this invention can be used for automobiles and other vehicles. Multiple glazing units of this invention can be used in security glazing for banks, prisons, armored trucks, inter alia.

It will be understood that the above-described embodiments of the invention are only for the purpose of illustration. Additional embodiments, modifications and improvements can be readily anticipated by those skilled in the art based on a reading and study of the present disclosure. Such additional embodiments, modifications and improvements may be fairly construed to be within the spirit, scope, and purview of the invention as defined in the claims.

### **Abstract**

A glazing unit comprising at least one monolithic glazing element bonded to at least one layer of a polymer having embedded therein at least one element of a fastening means adapted for mounting to a support structure. This construction provides an integrated connecting arrangement for the mechanical fastening of monolithic glazing units to a support structure to obtain a glazing assembly. A plurality of monolithic glazing units form glazing assemblies which when fixed in a planar array define a continuous smooth surface useful as exterior glazing facades. A clear gain is made, according to the invention is the simplicity of the installation of glass glazing facades to provide increased use in architectural designs. The invention is applicable to any glazing unit whether single, laminated, and/or multiple glazing elements are used.